International Journal of Engineering and Information Systems (IJEAIS)
ISSN: 2643-640X
Vol. 9 Issue 6 June - 2025, Pages: 57-60

Changes In The Oral Cavity Caused By Iodine Deficiency

Ergashev Bekzod

Central Asian Medical University, Burhoniddin Marg'inoniy Street 64, Phone: +998 95 485 00 70, Email: info@camuf.uz, Fergana, Uzbekistan

Email: bekzodergashev0401@gmail.com

ORCID: https://orcid.org/0009-0000-0382-0811

Abstract: *Iodine is a vital micronutrient essential for thyroid hormone synthesis, which plays a fundamental role in metabolism, growth, and development. Despite global efforts to eliminate iodine deficiency through dietary interventions, it remains prevalent in many regions, particularly in landlocked and mountainous areas. While the systemic effects of iodine deficiency—such as hypothyroidism, goiter, and developmental delays—are well-established, its influence on oral health has been understudied. This cross-sectional study aimed to investigate the structural and functional changes in the oral cavity associated with iodine deficiency and their correlation with serum iodine and thyroid hormone levels. A total of 100 participants (50 iodine-deficient and 50 healthy controls) aged 18–60 years were recruited. Clinical examinations assessed salivary gland function and mucosal integrity. Biochemical tests measured serum iodine and thyroid hormone levels, while histopathological analysis of oral mucosa biopsies provided insights into tissue changes. Results revealed that iodine-deficient individuals had significantly reduced salivary flow (by 45%), altered salivary composition, and increased prevalence of mucosal atrophy (70%) and recurrent infections (60%). Histological findings confirmed epithelial thinning and inflammatory infiltration. Additionally, dental caries and gingivitis were more prevalent in the iodine-deficient group. These findings suggest a strong association between iodine deficiency and deteriorating oral health, likely mediated by impaired salivary gland function and immune dysregulation. The study underscores the importance of integrating oral examinations into routine screening for iodine deficiency, especially in high-risk populations. Early recognition of oral signs could serve as a cost-effective and non-invasive tool for timely intervention in iodine-deficient individuals.*

Keywords: iodine deficiency, oral cavity changes, salivary dysfunction, mucosal atrophy, systemic impacts.

Introduction: Iodine is a critical micronutrient essential for the synthesis of thyroid hormones—thyroxine (T4) and triiodothyronine (T3)—which regulate various physiological processes, including metabolism, growth, and development [1]. The human body does not produce iodine; therefore, it must be obtained through dietary sources such as iodized salt, seafood, and dairy products. However, in many parts of the world, particularly in landlocked or mountainous regions, iodine deficiency remains a significant public health issue [2].

Iodine deficiency is widely recognized for its systemic effects, including hypothyroidism, goiter, and severe developmental disorders such as cretinism. Despite these well-documented impacts, its role in oral health has received comparatively little attention. The oral cavity, as a mirror of systemic health, often exhibits early signs of nutritional deficiencies, including iodine deficiency. These manifestations can include changes in salivary gland function, increased susceptibility to infections, and alterations in the oral mucosa, all of which can adversely affect quality of life [3].

Global Prevalence of Iodine Deficiency: According to the World Health Organization (WHO), nearly 1.88 billion people globally are at risk of iodine deficiency, with approximately 241 million individuals affected by goiter. Regions with inadequate soil iodine, such as parts of Asia, Africa, and Europe, are particularly vulnerable. In these areas, iodized salt programs have been implemented to mitigate deficiency, but challenges persist in ensuring universal access and compliance [4].

Oral Health and Iodine Deficiency: The oral cavity is not an isolated system; it is directly influenced by thyroid hormone levels and overall systemic health. Hypothyroidism, a common consequence of iodine deficiency, can lead to various oral health problems:

Salivary Gland Dysfunction: Reduced salivary flow or altered composition increases the risk of xerostomia, dental caries, and periodontal diseases.

Oral Mucosa Changes: Hypothyroidism can impair epithelial regeneration, leading to atrophic or inflamed mucosa [5].

Immune Dysregulation: Increased susceptibility to oral infections, such as candidiasis, due to compromised immune function.

Rationale for the Study: While the systemic effects of iodine deficiency have been extensively studied, its specific impact on the oral cavity is less understood. Early identification of oral manifestations could provide valuable diagnostic clues for iodine deficiency, particularly in regions where biochemical testing is not readily available. Furthermore, understanding these changes could aid in developing targeted interventions to improve both systemic and oral health outcomes.

Objectives:

This study seeks to:

1. Investigate the structural and functional changes in the oral cavity associated with iodine deficiency.

2. Examine the correlation between serum iodine levels and oral health indicators such as salivary flow rate, mucosal integrity, and prevalence of infections.

3. Propose strategies for early detection and management of oral health complications linked to iodine deficiency.

By shedding light on these aspects, this research aims to emphasize the interconnectedness of nutrition, systemic health, and oral health, advocating for a more integrative approach to healthcare.

Materials and Methods:

Study Design:

A cross-sectional study was conducted from January to July 2024 at a tertiary care hospital. Participant Selection.

Inclusion Criteria:

Adults aged 18–60 years.

Diagnosed with iodine deficiency through biochemical testing.

Exclusion Criteria:

Participants with other systemic conditions affecting oral health (e.g., diabetes).

History of recent dental treatment.

Data Collection Methods:

1. Clinical Examination:

Evaluation of salivary gland function using sialometry.

Examination of oral mucosa for signs of atrophy, inflammation, or lesions [3].

2. Biochemical Analysis:

Serum iodine levels measured using inductively coupled plasma mass spectrometry (ICP-MS).

Thyroid hormone levels (TSH, T3, and T4) assessed via immunoassay [4].

3. Histopathological Studies:

Biopsies of the oral mucosa analyzed for structural changes, including epithelial thickness and inflammatory cell infiltration [5].

Statistical Analysis: Data were analyzed using SPSS (version 27.0). Correlation between iodine deficiency and oral cavity changes was evaluated using Pearson's correlation coefficient. A p-value < 0.05 was considered statistically significant.

Results:

Participant Demographics. Total participants: 100 (50 iodine-deficient, 50 controls). Mean age: 40.5 ± 12 years. Gender distribution: 60% female, 40% male.

Salivary Gland Function:

Iodine-deficient participants showed a 45% reduction in salivary flow rate compared to controls.

Altered salivary composition with increased sodium ($p < 0.01$) and decreased potassium levels ($p < 0.05$) [6].

Oral Mucosa Changes:

70% of iodine-deficient participants exhibited mucosal atrophy.

60% reported recurrent oral infections, with Candida albicans being the most prevalent pathogen.

Dental and Periodontal Health:

Higher prevalence of dental caries (58%) and gingivitis (65%) in iodine-deficient individuals compared to controls [7].

Histopathological Findings

Epithelial atrophy and inflammatory cell infiltration were observed in 80% of biopsies from iodine-deficient participants.

Discussion:

Interpretation of Results: The results highlight the critical role of iodine in maintaining oral health. Iodine deficiency affects the oral cavity both directly, through its impact on mucosal health, and indirectly, via thyroid hormone dysfunction. Reduced salivary gland function leads to xerostomia, which compromises oral hygiene and increases the risk of infections and caries [8, 9].

Comparison with Previous Studies:

Our findings align with prior research demonstrating systemic and local effects of iodine deficiency. However, this study provides novel insights into the specific oral manifestations and their correlation with iodine levels [10, 11].

Clinical Implications:

Healthcare providers should consider oral health as a potential diagnostic marker for iodine deficiency. Integrating dental evaluations into routine care for at-risk populations can facilitate early detection and intervention [12, 13, 14, 15].

Limitations:

Small sample size limits generalizability.

Lack of longitudinal data to assess progression of oral changes.

Conclusion: This study provides compelling evidence linking iodine deficiency with a spectrum of oral health disturbances, reinforcing the interconnectedness of nutrition, endocrine function, and oral pathology. The significant reduction in salivary flow observed among iodine-deficient participants compromises one of the body's primary defense mechanisms against microbial invasion and dental decay. Altered salivary composition, characterized by increased sodium and decreased potassium levels, may further exacerbate vulnerability to caries and periodontal disease. Additionally, mucosal atrophy and a higher incidence of oral infections, especially candidiasis, reflect the detrimental effects of hypothyroidism on mucosal immunity and epithelial integrity. Histopathological analysis revealed notable tissue alterations, including epithelial thinning and inflammatory cell infiltration, offering microscopic validation of the clinical findings. These changes collectively contribute to a compromised oral environment, which not only affects oral health and function but also diminishes overall quality of life.

Importantly, the study highlights that the oral cavity may serve as an accessible and non-invasive window into the body’s nutritional and endocrine status. In resource-limited settings where biochemical testing for iodine levels may not be feasible, identifying oral manifestations could guide early diagnosis and prompt intervention. Dental professionals, alongside general healthcare providers, should be aware of these signs and play an active role in multidisciplinary approaches to managing iodine deficiency. While the study's cross-sectional design and limited sample size restrict the generalizability of findings, the associations observed warrant further longitudinal research. Future studies should explore the progression and reversibility of oral changes following iodine supplementation. In conclusion, iodine deficiency not only threatens systemic health but also poses significant risks to oral well-being. Public health strategies aimed at eliminating iodine deficiency should consider oral health implications, emphasizing preventive care, education, and interprofessional collaboration.

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